



# Cross-Level Moderation of Team Cohesion in Individuals' Utilitarian and Hedonic Information Processing: Evidence in the Context of Team-Based Gamified Training

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## Abstract

Firms currently use teams extensively to accomplish organizational objectives. Furthermore, gamification has recently attracted much attention as a means of persuading employees and customers to engage in desired behaviors. Despite the importance of teams and the growing interest in gamification as a persuasion tool, past researchers have paid little attention to team-based gamification from a multilevel perspective. Based on motivational consistency theories, we hypothesize that at the team level, team performance has a positive effect on team cohesion. Drawing on the elaboration likelihood model (ELM), we further hypothesize two cross-level effects in the context of team-based gamified training: first, that team cohesion positively moderates the relationship between utilitarian perceptions (i.e., perceived quality of learning) and attitude; and second, that team cohesion negatively moderates the relationship between hedonic perceptions (i.e., perceived enjoyment of learning) and attitude. We tested our research model using an enterprise resource planning (ERP) simulation game involving 232 participants in 78 teams. The results of ordinary least squares and hierarchical linear modeling analysis support our hypotheses. This study makes three substantive contributions to the team literature and to the ELM in the context of team-based gamified training. First, it theorizes and empirically tests the effect of team performance on team cohesion at the team level. Second, it extends the ELM by examining the cross-level moderation of team cohesion on human information processing. Third, it demonstrates that the utilitarian and hedonic aspects of information technology do not influence user attitudes equally.

**Keywords:** Team Cohesion, Team Performance, Gamification, Information Processing, Elaboration Likelihood Model, Utilitarian, Hedonic, Attitude, IT Training, ERPsims

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## 1 Introduction

In today's rapidly changing and highly competitive business environment, firms often use teams to accomplish their organizational objectives (Zhang, Venkatesh, & Brown, 2011). As such, organizations

have invested substantially in information technologies (IT) designed specifically to support team collaboration (Maruping & Magni, 2015). An important goal of team research has been to identify factors and processes that improve team performance (e.g., Choi, Lee, & Yoo, 2010). Such studies have often concentrated on the social and motivational influences

among team members (Beal, Cohen, Burke, & McLendon, 2003). Prior research has concluded that social and motivational forces create cohesion among team members and that strong team cohesion, in turn, leads to improved performance, because a cohesive team is more motivated and more collaborative (Beal et al., 2003; Huang, Wei, Watson, & Tan 2002; Venkatesh & Windeler 2012; Yang & Tang 2004). Team cohesion refers to a team member's sense of belonging to a team and his or her feeling of morale associated with membership in that team (Bollen and Hoyle, 1990). This study adds to the team cohesion literature by demonstrating that team performance can likewise affect team cohesion and by empirically examining the moderating role of team cohesion in individuals' information processing.

The specific focus of this study is on team-based gamification. Gamification, defined as "the use of game design elements in nongame contexts" (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011, p. 9), has recently received considerable attention as a means of persuading and motivating individuals to engage in various positive behaviors (Hamari, Koivisto, & Pakkanen, 2014). Gamification is diffused in a number of different contexts, such as training, education, defense, scientific exploration, leisure, health, politics, engineering, and charity (Sigala, 2015). For example, computer-based simulation games have been shown to improve employees' managerial and technical skills (Sitzmann, 2011). In particular, universities and corporate training programs have incorporated enterprise resource planning simulation games (ERPsim: Léger, Robert, Babin, Pellerin, & Wagner, 2007) into their curricula and training (Léger, 2006) because these games allow students and employees to gain insights into the integration and functionality of business and IT (Cronan, Léger, Robert, Babin, & Charland, 2012; Léger, Cronan, Charland, Pellerin, Babin, & Robert, 2012). The desired behavioral outcomes from gamification could be a result of the intrinsically motivating, gameful experiences supported by the game features (Hamari, Koivisto, & Sarsa, 2014). Although playing games is considered purely autotelic or hedonically motivated, gamification is commonly used to achieve utilitarian goals outside the game (e.g., increasing consumer loyalty, encouraging greener consumption, supporting healthier decision-making) (Koivisto & Hamari, 2014). Furthermore, gamification is often viewed as a persuasive technology designed for attitude formation and change (Hamari, Koivisto, & Pakkanen, 2014; Llagostera, 2012). For example, utilitarian perceptions of gamified services (e.g., perceived reciprocal benefits) have been found to positively affect attitudes toward those services (Hamari & Koivisto, 2013). In sum, the utilitarian and hedonic elements of gamification make it an effective persuasion tool for forming or changing attitudes.

Persuasion-based information systems (IS) research has focused to date on the types of external information/cues and an individual's information processing style that ultimately influence attitude change (Angst & Agarwal, 2009). Gamification as a persuasive technology is an effective instructional method because it concurrently engages trainees' cognitive and affective processes (Sitzmann, 2011; Tennyson & Jorczak, 2008). As discussed earlier, gamification—if designed successfully—consists of both utilitarian and hedonic elements. Gamification scholars argue that the utilitarian elements can effectively keep the trainees focused on the main objectives and tasks (Sitzmann, 2011), the processing of which is charged by the cognitive structure of the human brain (Kahneman, 2013). On the other hand, the hedonic elements induce a flowlike experience of the trainees by creating an immersive artificial environment (Léger, Davis, Cronan, & Perret, 2014). Such an experience is said to be processed by the affective structure of the brain (Kahneman, 2013). During a gamification process, its utilitarian and hedonic elements activate the cognitive and affective processing of the human brain in such an iterative and interactive fashion that the trainee is neither overly stressed by the goals and challenges nor overly controlled by the automatic flow of the simulation, making gamification an effective instructional method (Léger, Davis, et al., 2014, Tennyson & Jorczak, 2008). In examining cognitive and affective information processing, the elaboration likelihood model of persuasion (ELM) (Petty & Cacioppo, 1981, 1986) is an appropriate theoretical basis for identifying the factors that influence one's attitude toward gamification. The ELM postulates that attitudes can be formed and changed after either thoughtful consideration of a message (i.e., a central route) or by a simple inference that requires less cognitive effort (i.e., a peripheral route). The ELM has received much attention in IS research (e.g., Angst & Agarwal, 2009; Bhattacharjee & Sanford, 2006; Cheung, Sia, & Kuan, 2012; Ho & Bodoff, 2014) because of its demonstrated success in other disciplines and also because of its intuitive appeal in explaining why a specific persuasion process can lead to differential outcomes across a variety of individuals in a given behavioral context (Bhattacharjee & Sanford, 2006).

Despite the growing interest in gamification and the potential theoretical contribution of the ELM to gamification, there remain several opportunities to improve our knowledge of this phenomenon from a team perspective. A review of the literature on gamification and persuasion-based IS research yields only individual level empirical studies (e.g., Angst & Agarwal, 2009; Hamari, Koivisto, & Pakkanen, 2014; Ho & Bodoff, 2014). Although an individual level of analysis can help us understand the persuasion process, it does not provide a comprehensive guide as to how

individuals process information in a team setting. The team is a unique context for three reasons: (1) the importance of team as a gamification element, (2) the unique relationship between team performance and team cohesion, and (3) the role of team-based persuasion and information processing. These three reasons are further explained in the paragraphs that follow.

First, the term “team” itself, which refers to a defined group of players working together to achieve a common goal, is an important game component (Werbach & Hunter, 2012). Like collaboration technologies (Maruping & Magni, 2015), team-based gamification (e.g., ERPsim<sup>1</sup>) is designed to support teamwork. In the perspective of game mechanics, which generate user engagement, team members make decisions and collaborate to achieve a shared goal (i.e., *cooperation*), and each team competes against other teams (i.e., *competition*) (Werbach & Hunter, 2012). In addition, team-based gamification is social in nature (cf., Brown, Dennis, & Venkatesh, 2010) because an individual member’s decisions are generally triggered by the actions of other team members (Ilgen, Hollenbeck, Johnson, & Jundt, 2005). Furthermore, incorporating game elements into the team context (e.g., team performance via leaderboard) may encourage the engagement of the team as a whole rather than that of individual team members; this suggests that team-based gamification elements can influence team-level constructs. Although recent research on collaboration technologies underscores the cross-level effects of team-level constructs on individual-level perceptions and behaviors (Kang, Lim, Kim, & Yang, 2012; Maruping & Magni, 2015), no similar attempt has been made to examine the effect of team-based gamification elements.

Second, although empirical results have been varied, most extant research has found team cohesion to positively affect team performance (see Beal et al., 2003 for a review). Nevertheless, attitude models such as balance theory (Heider, 1958) and cognitive dissonance theory (Festinger, 1957) suggest that positive team performance outcomes may, in turn, result in positive attitudes toward the team and perceptions of other outcomes (e.g., “my team performed well, therefore we must be very knowledgeable on the subject of ERP concepts”). However, past research has largely ignored the potential effect of team performance on team cohesion.

Third, the ELM maintains that motivation (e.g., personal involvement) and ability (e.g., expertise) are the two most influential factors in determining which route works best in persuasion (Petty & Wegener, 1999). For instance, Sussman and Siegal (2003) proposed positive (vs. negative) moderation of involvement and expertise on the relationship between argument quality (vs. source credibility) and perceived message usefulness. However, these individual level moderating factors do not provide a complete understanding of an individual’s information processing in team settings. In addition, Kang et al. (2012) argued that “individual level constructs are not comprehensive enough because social processes moderate the effect of technology on users’ behaviors” (p. 215). In a team context, individuals depend on cues from their team members to form appropriate attitudes (Maruping & Magni, 2015). Moreover, an individual’s perceptions and attitudes are susceptible to the effect of situational and institutional conditions (Watson-Manheim & Belanger, 2007). Thus, the discovery of the moderating effects of team-level constructs on the individual level of information processing and persuasion would be a contribution and extension to the ELM.

Given the need for a multilevel perspective in team-based gamification, this study makes three important contributions to the team literature and the ELM in the context of team-based gamified training. First, it theorizes and empirically tests the effect of team performance on team cohesion at the team level. Second, it extends the ELM by examining the cross-level moderation of team cohesion in human information processing. Finally, it demonstrates that the utilitarian and hedonic aspects of IT do not influence user attitudes equally. In addition to offering these theoretical contributions, our findings enlighten managers to the fact that they possess a good degree of control over competition and are capable of inducing more desirable levels of team cohesion. In the following section, we review the relevant literature on gamification and the theoretical background of the ELM. Next, we present our research model and hypotheses. Then, we describe our research methods and present the results of our multilevel analysis. We conclude with theoretical and practical implications, limitations, and future research directions

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<sup>1</sup> ERP systems, or enterprise systems, facilitate integration of various business processes and thus require team collaboration (Léger et al., 2012). In learning ERP systems, the ERP simulation game (ERPsim) has become an increasingly recognized application over the past decade. It is now used by more than 3,000 university students each year at over 70 universities worldwide (Léger et al., 2010). Many

Fortune 1000 organizations now use it to train employees (Léger et al., 2010). In a simulated near-real-life business environment of large corporate information systems, ERPsim helps team members make decisions (e.g., pricing products and forecasting inventory level) as a team and learn how to work in a team (Léger et al., 2010; Léger, et al., 2011).

## 2 Theoretical Background

### 2.1 Gamification and ERPSim

*Gamification* has been referred to by many names in the past, including “productivity games”, “surveillance entertainment”, “funware”, “playful design”, “behavioral games”, “game layer”, and “applied gaming” (Deterding et al., 2011, p. 9). After the success of Foursquare/Swarm in using game design elements such as points and badges to encourage user activity and retention, firms’ interest in using gamification has dramatically increased (Deterding et al., 2011; Frith, 2013). Moreover, gamification is diffused in the nonprofit sector. For example, CrowdRise is a platform that gamifies charities by using basic gamification techniques, such as points, badges, and leaderboards, to engage users to participate in fundraising and donations (Tsotsis, 2014).

According to Hamari (2013), gamification can be defined two ways. One widely accepted definition is the use of game elements and game design techniques in nongame contexts (Deterding et al., 2011; Werbach & Hunt, 2012). This definition distinguishes “serious games” or “applied games” (the design of full-fledged games to solve a problem) from “gamified” applications that only need to use some game design components (Sigala, 2015). The second definition refers to the process of facilitating a service with affordances for gameful experiences that supports a user’s overall value creation (Huotari & Hamari 2012). This definition suggests that organizations only provide affordances for customers to experience gamefulness, and that customers decide for themselves whether to engage in gameful experiences and whether the perceived benefits of the service are subsequently enhanced (Hamari, 2013). Despite the value of customer engagement associated with the *gameful affordance* definition of gamification, our research centers on the use of game design and elements (i.e., teams and leaderboard) in nongame contexts (i.e., ERP learning). Thus, our work aligns more closely with the first definition.

In reviewing the gamification literature, Hamari, Koivisto, and Sarsa (2014) identified several commonly used game elements: points, leaderboards, achievements/badges, levels, stories/themes, clear goals, feedback, rewards, progress, and challenges. Among these, points, badges, and leaderboards (PBL) are the most well-known and frequently used game elements (Hamari & Eranti, 2011). Although the team (e.g., “guild” in World of Warcraft) is also an important game element (Werbach & Hunt, 2012), prior empirical research on gamification (see Hamari, Koivisto, & Sarsa, 2014 for a review) has not sufficiently examined the team as a gamification element, partly because past researchers have focused on the individual-level aspects of gamification.

Among the several types of team-based gamification, we are particularly interested in ERPSim as our research context for three reasons. First, the successful implementation by businesses of ERP systems has dramatically increased their operational efficiency and business performance; and thus, many large- and medium-sized firms have subsequently adopted ERP systems (Liang, Saraf, Hu, & Yajiong, 2007). The importance of ERP systems has led to a rich body of ERP research on topics such as adoption and implementation (Markus & Tanis, 2000), assimilation (Liang et al., 2007), and job characteristics and satisfaction (Morris & Venkatesh, 2010). Second, user training is considered a key factor in any successful IT implementation (Compeau, Olfman, Sein, & Webster, 1995). Because an ERP system implementation generally involves a substantial redesign of business processes, and because it is typically a very complex system (Robey, Ross, & Boudreau, 2002), user training is critical to reducing the probability of ERP implementation failures. Third, ERPSim is a very popular ERP training tool in both academia and firms (Cronan et al., 2012; Léger et al., 2010).

### 2.2 The Elaboration Likelihood Model of Persuasion

The ELM (Petty & Cacioppo, 1981, 1986) is a persuasion theory describing the processes responsible for attitude change and the strength of the attitudes that result from those processes. The ELM posits that attitude change can occur through two qualitatively different routes. A key construct in the ELM is the *elaboration likelihood*, which determines the route to persuasion. Elaboration likelihood is generally defined by how motivated and able individuals are to evaluate the key merits of a focal object. When people are highly motivated and able to assess the merits of the object (i.e., high elaboration likelihood), they are more likely to expend cognitive effort to scrutinize all available object-relevant information (i.e., the *central route*). Therefore, they tend to be persuaded by the quality of an argument, which requires more cognitive effort. However, when elaboration likelihood is low, information scrutiny is decreased because of processes that make lesser demands for cognitive resources and do not require much effort in assessing the object-relevant information (i.e., the *peripheral route*). In turn, people in a low elaboration likelihood state tend to be motivated more by peripheral (e.g., source attractiveness, source likeability) than central cues. Bhattacharjee and Sanford (2006) have emphasized that elaboration likelihood “is not a personality trait or an individual difference, but rather a temporal state that may fluctuate with situational contexts and time, even for the same individual” (p. 809).

Although individuals’ motivations and abilities have been examined as elaboration states, research has also

investigated social groups as an important persuasion context (Petty, Harkins, & Williams, 1980; McGarty, Haslam, Hutchinson, & Turner, 1994). For example, Petty et al. (1980) investigated the role of group size and found that people expend more cognitive effort in processing a stimulus when they are individually responsible for a task than when they are part of a group. This is because people in such situations diffuse the responsibility for cognitive tasks. Petty and Cacioppo (1986) note that group membership acts as a peripheral cue, which leads to superficial and associated processing of the message. In addition, McGarty et al. (1994) argue that outgroups are less persuasive than ingroups under the condition of salient group memberships in terms of individuals obligating themselves to such groups. Finally, See and Petty (2006) demonstrate that among mortality salient participants, ingroup members receive moderately favorable evaluations regardless of their positions, whereas outgroup members received positive or negative evaluations depending on the position taken. More recently, Barden et al. (2014) examined how one's group membership influences hypocrisy judgement. They found that reversed order of statement and behavior (i.e., doing one thing and then saying another) reduced hypocrisy judgments when people judged ingroup targets, as compared to outgroup targets. Further, ingroup membership has been shown to change self-identify even if it should be irrelevant (Briñol, DeMarree, & Petty, 2015). In an experiment of social group prime, Briñol et al. (2015) primed the subjects by having them write an essay imagining they were a person of a particular race (i.e., the primed target). They found that Caucasian students whose primed target were African American students from the same university anticipated a higher likelihood of being discriminated against in the future than those whose primed target were Caucasian. The results imply that a seemingly irrelevant ingroup status (i.e., being the same university student) is powerful enough to instigate perceptions (i.e., discrimination) of a different race.

Although prior persuasion research on social groups has mainly focused on the individual level, the importance of the social group emphasizes the need for a multilevel perspective in the study of persuasion. Strictly macrolevel approaches overlook individuals' information processing, but strictly microlevel approaches disregard how macrolevel contexts such as teams can determine the route to persuasion (Maruping & Magni, 2015). Therefore, examining *both* team- and

individual-level factors is necessary to understand how people process information within teams.

Drawing from the literature on social groups with respect to the ELM and gamification, we selected four key sets of constructs to examine the effect of social groups on individual-level information processing in the context of team-based gamified training: *perceived quality* (of learning via ERPs), *perceived enjoyment* (of learning via ERPs), *attitude* (toward learning via ERPs) at the individual level, and *team cohesion* at the team level. Drawing on argument quality (Bhattacharjee & Sanford 2006), perceived quality refers to the persuasive strength of ERP learning embedded in ERPs. Based on hedonic motivation (Venkatesh, Thong, & Xu, 2012), perceived enjoyment is defined as fun or pleasure derived from learning via ERPs. Thus, perceived quality and perceived enjoyment, respectively, capture the utilitarian and hedonic aspects of gamification. Attitude, defined as an individual's positive or negative evaluation of learning via ERPs (Ajzen, 1991), has been typically employed in many ELM studies (Angst & Agarwal, 2009).

### 3 Research Model and Hypotheses

We present our research model Figure 1. The key outcome of interest is attitude toward learning via ERPs. However, for the sake of completeness, and in line with a recent stream of ELM-based IS research (e.g., Angst & Agarwal, 2009), we also include intention to learn about ERP systems as an additional dependent variable. Given that the quality-attitude, enjoyment-attitude, and attitude-intention relationships have already been thoroughly examined in prior persuasion research (e.g., Angst & Agarwal, 2009; Bhattacharjee & Sanford, 2006; Hassanein & Head, 2007), we do not formally hypothesize these relationships. Our three research hypotheses are developed below.

#### 3.1 The Effect of Team Performance on Team Cohesion

In a cohesive team, team members have a strong sense of belonging to their team and increased feelings of morale related to team membership (Bollen & Hoyle, 1990). A sense of belonging makes team members desire association with their fellow team members, and a feeling of morale motivates them to accomplish organizational goals and objectives (Bollen & Hoyle, 1990; Chin, Salisbury, Pearson, & Stollak, 1999).



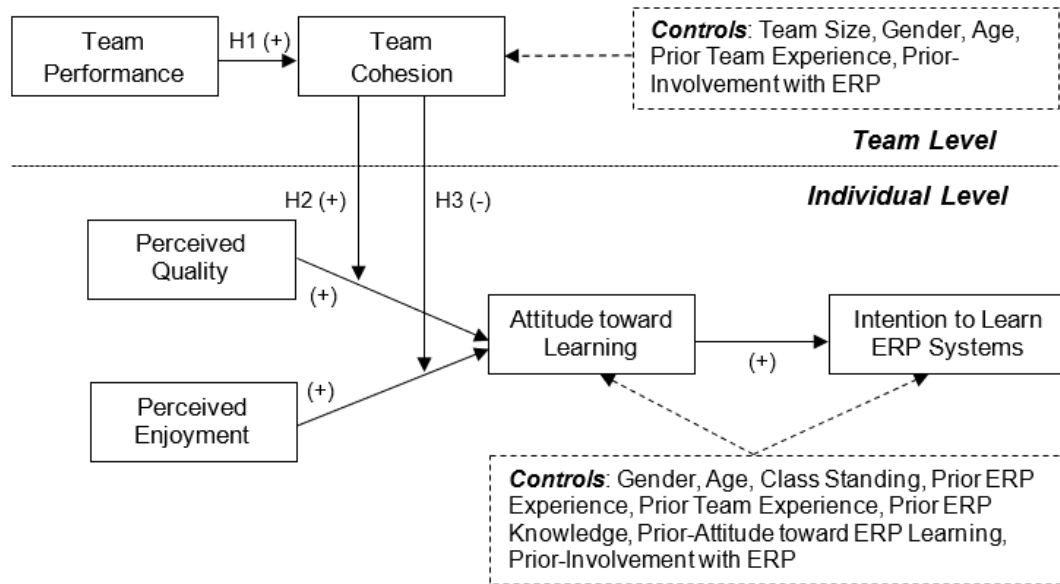


Figure 1. Research Model

Cohesive teams share information more effectively and have higher member satisfaction and better team performance (Beal et al., 2003; Curşeu, 2006; Yang et al., 2015). The teamwork literature has drawn a considerable link between team cohesion and performance; and researchers often attribute performance to the level of team cohesion. For example, Beal et al.'s (2003) meta-analysis found stronger correlations between cohesion and performance when performance was defined as behavior (as opposed to outcome) and when it was measured as efficiency (as opposed to effectiveness).

Prior IS research has examined antecedents and consequences of team cohesion in various contexts. For example, Huang, Wei, Watson, and Tan (2002) found that a group support system with an embedded goal-setting structure enhanced the cohesion of virtual teams. Yang and Tang (2004) show that team cohesion increases performance in information systems development teamwork. Venkatesh and Windeler (2012) found that team cohesion influenced team performance in the context of using virtual worlds for team collaboration. Yang, Tong, and Teo (2015) show that awareness of members' skill and perception of shared governance increases perceived team cohesion, which in turn influences team performance and satisfaction toward team members. In sum, prior IS research has supported the positive effect of team cohesion on team performance (Venkatesh & Windeler, 2012; Yang & Tang, 2004; Yang et al., 2015).

While we do not disagree with this literature, we dare to differ from prior research by positing that better

team performance also leads to better team cohesion. The prior literature on this subject offers insights into the antecedent role of cohesion and takes a *retrospective* instead of a *prospective* stance on performance (Beal et al., 2003). In other words, prior researchers have tended to position the cohesion-performance relationship as a means of *explaining* rather than *understanding* the ramifications of performance. However, as Williams & Hacker (1982) rightly point out, a mere correlation does not necessarily rule out the possibility that performance may cause cohesion to change. They further demonstrate empirically that cohesion and performance may indeed reciprocally cause each other, implying a circular relationship, and that preliminary results point to a causal influence of performance on cohesion (Williams & Hacker, 1982). Since more recent researchers have started to focus on how performance outcomes can be leveraged to induce a desirable level of team cohesion (e.g., Callow, Smith, Hardy, Arthur, & Hardy, 2009), it has become increasingly necessary to examine how performance may influence cohesion in the context of team-based gamified training.

Our argument that better team performance may lead to better team cohesion is based on the theories of motivational consistency (e.g., Heider, 1958; Osgood & Tannenbaum, 1955). A range of different factors can affect individuals' perceptions about their external environments, with such perceptions tending to evolve over time. This process keeps the psychological mind in a "healthy" state. According to balance theory and

the cognitive consistency motive (Heider, 1958), people are motivated to adjust their attitudes so that their cognition is consistent with the outside world. The rationale is that people have an urge to think in such a way that things happening in the external world will make sense to them. This allows them to maintain a high level of psychological balance and peace of mind. Adaptation level theory (Helson, 1996) further states that an individual's reference point for subjective evaluations on any stimuli is based on his or her past exposure to such stimuli and memory of prior judgments of comparable stimuli. According to adaptation level theory, team performance can be a reference point for forming perceptions of team-related outcomes such as team cohesion. Knowing that their team ranked at the top would make team members think that "my team performed very well, therefore we must be a cohesive team". Thus, we posit:

**H1:** Team performance (at the team level) positively influences team cohesion (at the team level).

### 3.2 The Cross-Level Moderating Effect of Team Cohesion

We expect the effect of perceived quality (of learning via ERPsims) on attitude (toward learning about ERP) to be positively moderated by team cohesion. This is based on the idea that members in a cohesive team are more likely to spend cognitive effort and evaluate the central merits of gamified training. One of the well-known phenomena in the social psychology of groups is the concept of "social loafing", which refers to individuals being less likely to expend their maximum effort when they are members of a group faced with a task requiring time and energy and when others are available to respond (Latané, Williams, & Harkins, 1979).

In particular, the diffusion of responsibility hypothesis suggests that individuals in groups may feel less personal responsibility for their behavior (Latané & Darley, 1976; Alnuaimi, Robert, & Maruping, 2010), and thus they are less willing to exert physical effort on tasks such as pulling a rope, helping a victim, reporting an emergency, or answering the door (see Petty et al., 1980). Petty and his colleagues (1977, 1980) have further argued that social loafing is not limited to tasks demanding physical effort but can be extended to cognitive tasks. In their study on the role of group size in cognitive activity, they found participants were less likely to engage in effortful cognitive activity when they shared responsibility for cognitive work with others than when they alone were responsible. Nevertheless, teams often have better informational resources to resolve complex, knowledge-intensive problems (Maruping & Magni, 2012). Team interaction can lead to increased cohesion and thus to a willingness to exert extra cognitive effort (Petty, Harkins, Williams, & Latané, 1977). Moreover, individuals who are immersed in an interactive team

environment that motivates and supports experimentation and learning are more likely to produce new and creative ideas (Maruping & Magni, 2012).

Increasing cognitive effort enables people to investigate the central benefits and features of a stimulus. Individuals in a cohesive team are more bonded to a group than are individuals in a less cohesive team. They will feel more responsibility to their team and try harder to achieve objectives for the team as a whole. In turn, members in cohesive teams are more likely to expend cognitive effort because of their bond with their team and their increased responsibility as a team member. The ELM maintains that the level of cognitive effort determines whether the route to persuasion is central or peripheral. The more cognitive effort one spends, the more likely one will use the central route (i.e., being more elaborative) in processing a message. According to this logic, members in a more cohesive team will expend more cognitive effort and be more likely to depend on the central route to persuasion. Quality of learning is a central value that can be achieved via ERPsims. Thus, it is reasonable to assume that members of cohesive teams would find their attitudes toward learning affected more by the quality of learning than by enjoyment of learning.

**H2:** Team cohesion (at the team level) *positively* moderates the relationship between perceived quality and attitude (at the individual level) so that the effect of perceived quality will be stronger for individuals in teams with high cohesion compared with individuals in teams with low cohesion.

We also posit that team cohesion will negatively moderate the relationship between perceived enjoyment (of learning via ERPsims) and attitude (toward learning ERP). In other words, we expect that the relationship between perceived enjoyment and attitude becomes more positive among members of *less* cohesive teams. This is based on the aforementioned argument that individuals who exert low cognitive effort will be more likely to depend on peripheral cues (Petty & Cacioppo, 1986). Peripheral cues refer to environmental characteristics (or meta-information) of the persuasive information/messages without a demanding process of interpreting message arguments (Bhattacharjee & Sanford, 2006; Petty & Cacioppo, 1986). That is, in a peripheral state of mental processing, the more directly perceivable a value is, the more likely the judgment of a message will be affected by it (Ho & Bodoff, 2014; Petty & Briñol, 2015). In the context of training using ERPsims, enjoyment provides for a peripheral value of learning via ERPsims. Though not considered a central value of the simulation-based training, enjoyment is viewed as an important affective feature that strengthens the appeal of a system as a learning environment (cf.,

Zhang, 2013). The degree to which a website is visually attractive, fun, and interesting has been considered part of website (system) quality (Jiang & Benbasat, 2007). Furthermore, an enjoyable system is playful and immersive; thus, for the trainees, its hedonic value keeps them motivated and engaged in the training process and it is easily accessible without requiring a heavy load of mental processing (Léger et al., 2014; Zhang, 2013). Following this rationale, members in a *less* cohesive team would be less likely to expend cognitive effort but instead depend more on the hedonic aspects of learning via ERPsim. In turn, they would tend to attribute their attitude toward learning more to the enjoyment of learning.

**H3:** Team cohesion (at the team level) *negatively* moderates the relationship between perceived enjoyment and attitude (at the individual level) so that the effect of perceived enjoyment will be stronger for individuals in teams with low cohesion compared with individuals in teams with high cohesion.

## 4 Methodology

We conducted a laboratory experiment in an integrated business process team setting using ERPsim, which is designed to teach ERP concepts and competencies. In particular, ERPsim is designed

*(1) to develop a hands-on understanding of the concepts underlying enterprise systems, (2) to experience the benefits of enterprise integration firsthand, (3) to develop technical skills at using an ERP system, (4) to learn how to work in a team, and (5) to learn how to strategize in a real-time business environment.* (Léger et al., 2010, p. 330)

ERP systems facilitate process integration that requires collaboration of various stakeholders (Léger et al., 2010). Because in real life stakeholders involved in an integrated business process are not considered a team, we adopted the notion of integrated business process teams (Caya, Léger, Grebot, & Brunelle, 2014). The system setting was identical for each team during the experiment, and we carefully followed the methodological guidelines of using ERPsim for conducting group experiments (Léger, Riedl, & vom Brocke, 2014; Caya et al., 2014), in order to ensure external validity.

### 4.1 Subjects and Procedures

To test our research model, we conducted a laboratory experiment at a large public university in the United States. The participants were business school students who were registered in an introductory IT course. The course included a lab discussion section in which practical software skills (e.g., Excel, Access) were

taught. ERPsim was also a required activity in the discussion section, with the course employing a distribution game (Léger et al., 2010). This game is appropriate for use in introductory classes because it is a basic version of ERPsim. ERPsim is the first teamwork exercise in the course.

The procedure was as follows. The instructor (one of the authors) randomly assigned each student to a team (or in a few cases a dyad) in each experimental session. Because of the entry level of ERP learning and to reduce the complication of using e-communication channels, verbal discussion was the only means of team interaction used. A low voice level was maintained during the entire course of each session in order to mitigate cross-team distraction. Each student was seated in front of a designated computer. The seats of each team were close to each other in the same row and were kept some distance from the other teams; as such, each student had easy access to teammates' computer screens. This was to ensure effective communication for resolving questions and issues that might emerge during simulation games. In-session observations made by the instructor confirmed that all teams had relatively comparable levels of communication intensity. Thus, we may reasonably rule out the possible influence of team dynamics on performance and cohesion.

Upon arrival and before the experimental session began, students had informed consent to participate in a classroom experiment. With their agreement, the students were asked to fill out a pregame survey that measured ERP knowledge and various demographic information (see Appendix A for details). They subsequently watched an introductory ERPsim video, after which an instructor (one of the authors) explained the basic concepts of ERP and gave instructions on ERPsim in terms of login, team objectives, SAP interfaces, and SAP modules. Next, each team played the game against other teams. After the game concluded, the instructor showed a leaderboard that included team performance (e.g., rank). Finally, students filled out a postgame survey that included the constructs in the research model (see Appendix A for details). A total of 232 students organized into 78 teams in 10 discussion sections participated in the study. The sample consisted of 145 males (62.5%) and 87 females (37.5%). A majority (83.6%) of the participants were between 18 and 21 years of age. The sample included freshmen (31.9%), sophomores (30.6%), juniors (29.3%), and seniors (8.2%).

We randomly assigned four students to each team, but some of the participants were not present for the course activity. Therefore, we checked team size bias and class assignment bias using control variables such as ERP knowledge (ERP\_KN), prior ERP experience (ERP\_EXP), and prior team experience (TEAM\_EXP); all variables were measured before the



ERPsim game began. The means of the variables were not significantly different across the 10 discussion sections (ERP\_KN:  $F = 1.347$ ,  $p > .05$ ; ERP\_EXP:  $F = 0.61$ ,  $p > .05$ ; TEAM\_EXP:  $F = 0.62$ ,  $p > .05$ ) or across team sizes (ERP\_KN:  $F = 0.73$ ,  $p > .05$ ; ERP\_EXP:  $F = 0.15$ ,  $p > .05$ ; TEAM\_EXP:  $F = 2.41$ ,  $p > .05$ ), suggesting the absence of any bias regarding class assignment and team size.

## 4.2 Measurement

*Team Level Constructs:* To ensure construct validity, all measures were adapted from existing validated scales whenever possible (see Appendix A for a complete list of measurement items). Team performance was measured at the team level by using team rank within each class. The scale for team cohesion was adapted from Chin et al. (1999). Because team cohesion was conceptualized at the team level, we followed a referent-shift consensus method in phrasing these items and collected responses at the individual level (Chan, 1998). We subsequently transformed the individual level measure to the team level by averaging the responses from all members of a given team (see Maruping & Magni, 2015). To assess the appropriateness of aggregating the individual level measures of team cohesion to the team level, we relied on several diagnostic statistics, as described below.

First, the median within-group agreement statistic ( $r_{wg(j)}$ ), which is akin to the intercoder agreement index (James, Demaree, & Wolf, 1984), was .91 (much higher than the minimum acceptable value of .70), indicating a high level of agreement between the individual ratings of the items within teams. Second, results of a one-way analysis of variance (ANOVA) of the individual measure treated as the dependent variable, with team assignment as the independent variable, indicate that teams significantly differ from each other in their members' ratings of the scales ( $F = 1.40$ ,  $p < .05$ ), hence supporting the validity of aggregating the measure from individuals to the team. Next, we conducted a null hierarchical linear modeling (HLM) model on the individual measure of team cohesion—in which only an intercept term and a random intercept component were specified (Raudenbush & Bryk, 2002)—to assess the significance of the between-team variances. The results indicate that under a hierarchical model, between-team variance was significantly different from zero ( $p < .05$ ), thus indicating a significant amount of group-effects in team cohesion. Finally, we looked at intraclass correlations—i.e., ICC(1) and ICC(2)—which are commonly used criteria for

validating the aggregation of individual level variables into a group level.

ICC(1), which quantifies the amount of between-team variation in the individual measure of team cohesion, was .08 in our data, exceeding the commonly accepted threshold of .06 for field studies (Liao & Chuang, 2004). ICC(2), which evaluates the reliability of the team-level measure as aggregated from the individually collected data (Bliese, 2000), was .26. Although there is consensus in the extant literature that an ICC(2) value of .45 is acceptable for field studies, there are no strict standards as to what level of ICC(2) is acceptable (Schneider et al., 1998). An important reason for this is that ICC(2) is highly dependent on the average group size, and hence cross-study comparisons of ICC(2) are inappropriate if differences in group sizes (Bliese, 1998) are ignored. Although our ICC(2) value is slightly below the average values reported in the extant multilevel research (e.g., Liao & Chuang, 2004), we note that the main consequence of a weak ICC(2) is that the group level effect would be underestimated, making it more difficult to detect statistical significance (Bliese, 1998). Because our objective is to explore whether there exists a cross-level moderation effect of team cohesion on the individual level effects, a relatively weak ICC(2) actually implies a *higher* standard for our hypothesis testing. In other words, if ICC(2) were lower, we would have had to observe a stronger cross-level moderation effect of team cohesion before we could establish the statistical significance of an effect. Given that all criteria for evaluating the validity of aggregation, except for ICC(2), passed the common standards, we conclude that it is appropriate to aggregate the individual level measure of team cohesion into the team level.

*Individual Level Constructs:* Perceived quality, perceived enjoyment, attitude, and intention to learn were all measured at the individual level. Items for perceived quality were adapted from Bhattacharjee and Sanford (2006); items for perceived enjoyment were adapted from Venkatesh et al.'s (2012) scale of hedonic motivation. Attitude was measured using semantic differential scales designed by Ajzen (1991). We used scales from Davis, Bagozzi, and Warshaw (1989) to measure intention to learn ERP systems. After developing the scales, several faculty members and doctoral students pretested and gave feedback on the validity of the content and clarity of the questionnaire. After the pretests, we conducted a pilot test on 16 undergraduates to determine the reliability of the scales. The lowest Cronbach's alpha on the pilot test was .84 (Intention to Learn), suggesting satisfactory reliability for all study constructs.

Table 1. Correlations and Descriptive Statistics

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Individual level</i>															
1. Quality	<b>.91</b>														
2. Enjoyment	.79***	<b>.93</b>													
3. Attitude	.78***	.80***	<b>.90</b>												
4. Intention	.62***	.62***	.67***	<b>.90</b>											
5. Gender	-.11	-.22***	-.20**	-.27***	-										
6. Age	-.02	.00	.13	.06	-.08	-									
7. Class standing	-.03	-.01	.06	-.06	-.04	.49***	-								
8. Prior ERP experience	.13	.09	.09	.18**	-.10	.19**	.11	-							
9. Prior team experience	-.15*	-.12	-.12	-.08	-.03	.01	.23***	.03	-						
10. Prior ERP knowledge	.16*	.17**	.09	.21**	-.07	.01	-.11	.39***	-.13	<b>.95</b>					
11. Prior attitude	.17**	.18**	.21**	.26***	-.03	.14*	.07	.16*	.08	.21**	<b>.89</b>				
12. Prior involvement	.29***	.20**	.26***	.33***	-.06	.11	-.03	.20**	-.05	.44***	.34***	<b>.89</b>			
<i>Team level</i>															
13. Team cohesion	.22**	.24***	.20**	.22**	-.13	-.03	-.09	-.03	.03	.07	-.04	.10	<b>.86</b>		
14. Performance rank	-.10	-.09	-.11	-.05	.10	-.04	-.03	-.04	.07	-.09	.05	.06	-.34***	-	
15. Team size	-.11	-.13	-.16*	-.07	.06	.00	.08	-.04	-.03	-.06	.06	-.14*	-.34***	.17**	-
Mean	5.31	5.36	5.71	4.92	1.38	20.41	2.15	1.69	4.31	2.67	5.00	3.88	6.06	4.50	2.97
S.D.	1.34	1.47	1.20	1.45	.49	2.88	.99	1.05	2.42	1.53	1.26	1.30	.62	2.26	.58
CR	.94	.95	.93	.93	-	-	-	-	-	.97	.93	.92	.94	-	-
AVE	.83	.87	.80	.81	-	-	-	-	-	.91	.80	.80	.74	-	-
Notes: 1. N = 232 (individual level), N = 78 (team level). 2. <b>Bolded values</b> along the diagonal are the <b>square root of AVE</b> . 3. Gender: (1 = male, 2 = female). 4. Class standing: (1 = freshman, 2 = sophomore, 3 = junior, 4 = senior). 5. *p < .05, **p < .01, ***p < .001.															

#### 4.1 Measurement Model

Our scales were adapted from prior literature. We began by using AMOS 21.0 (Byrne, 2009) to perform a confirmatory factor analysis (CFA) of all latent constructs. The model demonstrated good fit with the data (Chin, Gopal, & Salisbury, 1997; Gefen, Straub, & Boudreau, 2000):  $\chi^2$  (296) = 435.31,  $\chi^2/\text{df}$  = 1.47, RMSEA = .05, SRMR = .03, CFI = .98, GFI = .88, and AGFI = .85. Composite reliability scores for the reflectively measured scales ranged from .92 to .97, exceeding the .707 recommended guideline (see Table 1). Convergent validity was assessed based on examining the standardized factor loadings as well as average variance extracted (AVE), for each construct (Table 1). All standardized factor loadings were above

the preferred .707 threshold except for one indicator for team cohesion that had a factor loading of .62. However, we did not consider it a significant concern because we adapted this item from Chin et al. (1999) and it is still above the established threshold of .60 (Chin et al., 1997). The AVE of all constructs exceeded the threshold of .50 (Fornell & Larcker, 1981; Chin et al., 1997). Finally, discriminant validity was established based on the square root of the AVE for each construct exceeding the construct's correlations with other constructs.

Given that ERPsim is designed to facilitate users' utilitarian and hedonic motivations, a high correlation between perceived quality and perceived enjoyment was not unexpected. However, the relatively high correlation between these two constructs could reflect

multicollinearity problems in the research model. Thus, we investigated the variance inflation factor (VIF) scores for all model constructs (including interaction terms) and control variables together. The highest VIF scores were 2.7 for perceived quality and 2.6 for perceived enjoyment. These are well below the threshold of 3.3 suggested by Craney and Surles (2002), indicating no serious problems with multicollinearity in the data.

## 4.2 Common Method Bias

Common method bias is a possible concern because our research study employed survey methods (Kang et al., 2012; Maruping & Magni, 2012, 2015). We addressed this concern in several ways. First, we captured team performance by using an objective measure from a leaderboard (i.e., team rank), and measured team cohesion by using multiple respondents from each team, as previously described. In addition, our research design scheduled pre- and post-training measurements of various constructs at different times. We also reduced participants' evaluation apprehension by emphasizing that there were no right or wrong answers to the survey items.

We also formally tested for potential common method bias in several ways. First, we conducted a Harman's single factor test by including all items of team- and individual-level constructs and controls in an exploratory factor analysis (Podsakoff & Organ, 1986). The first factor extracted did not account for a majority of the variance in the items (38.3%). Second, we performed two CFAs with the items for the four individual level constructs: one with four factors specified and the second with only one factor specified. When method variance is problematic, a single factor model will fit the data as well as a more complicated model (McFarland & Sweeney, 1992). The four-factor model showed an acceptable model fit ( $\chi^2 = 89.52$ ,  $df = 48$ ,  $\chi^2/df = 1.87$ , CFI = .99, NFI = .97, GFI = .94, AGFI = .90, and RMSEA = .06) but the one-factor model showed a poor fit ( $\chi^2 = 712.26$ ,  $df = 52$ ,  $\chi^2/df = 13.19$ , CFI = .79, NFI = .77, GFI = .63, AGFI = .47, and RMSEA = .23). Furthermore, a chi-squared difference test ( $\chi^2 = 622.74$ ,  $df = 4$ ,  $p < .001$ ) confirmed that the four-factor model had better fit. Thus, it is reasonable to conclude that it is unlikely that common method bias was a concern in our study.

## 4.3 Hypothesis Testing of Cross-Level Effects

It is assumed that the team-individual structure in our empirical setting requires a more sophisticated model

than what can be analyzed via structural equation modeling (SEM) or ordinary least squares (OLS) regression. Hierarchical linear modeling is preferred here over SEM or OLS because HLM simultaneously controls for a nonindependent error structure (i.e., between-team variation in our context) that is pertinent to the hierarchical structure while producing consistent estimation (Raudenbush & Bryk, 2002).<sup>2</sup> On the other hand, OLS generally produces biased estimation under a hierarchical structure. This is especially true when the focus of the analysis is on cross-level moderation effects—i.e., H2 and H3 (Ma, Kim, & Kim, 2014). To derive the estimation results, HLM relies on a restricted maximum likelihood (RML) algorithm that is more appropriate for the field setting of the ERPsim than for controlled lab experiments (Maruping & Magni, 2015). The RML algorithm produces a statistic called “deviance” (a badness-of-fit metric) that allows us to formally test the amount of improvement in the goodness-of-fit of a research model with respect to its baseline (nested) model.<sup>3</sup> We assume that deviance follows a chi-squared distribution, allowing for a chi-squared test of model comparison.

In order to facilitate appropriate interpretation of the coefficient estimates, HLM requires mean-centering of the variables at lower levels in relation to the group means (Hofmann & Gavin, 1998; Enders & Tofighi, 2007). Therefore, we group-mean centered and normalized all the individual level constructs. Doing this also helped us minimize multicollinearity for the interaction terms. For all other research constructs, including team cohesion and controls, we normalized the scales for better comparison across the results.

*Test of the team-level model:* Table 2 presents the models tested and results of the HLM analysis. To test the main effect of objective team performance (i.e., rank performance) on team cohesion, we used only OLS at the team level. Although teams were nested within classes and a HLM with class-team structure is assumed to be preferred over OLS, we did not find a significant amount of between-class variance (ICC(1) was too small to prefer HLM to OLS). Thus, in this circumstance OLS is more preferred. According to Model 1 of Table 2, rank performance had a significant negative effect on team cohesion ( $\beta = -.39$ ,  $p = .02$ ). Because low rank implies better team performances, a negative effect of rank means a positive effect of team performance on team cohesion, thus supporting H1. This model explained 14 percent of the total variance in team cohesion *at the team level*, up by 5.2 percentage points from the baseline model exclusive of rank performance.

<sup>2</sup> We used the Mixed procedure in the SAS 9.4 package to implement HLM in accordance with the recent literature (e.g., Ma et al., 2014).

<sup>3</sup> Deviance is calculated as negative two times the log likelihood of a converged model.

Table 2. Model Results

Independent variables	Dependent variables					
	Team level		Individual level			
	Model 1: Team cohesion		Model 2: Attitude		Model 3: Intention	
	Estimate	<i>p</i>	Estimate	<i>p</i>	Estimate	<i>p</i>
INTERCEPT	1.44	.01*	-.85	.01*	-.18	.66
Individual-level main effects						
Quality			.38	.00***		
Enjoyment			.49	.00***		
Attitude					.60	.00***
Individual-level controls						
Gender			-.08	.29	-.28	.00**
Age			.04	.01**	.00	.88
Class standing			.00	.98	-.11	.05
Prior ERP learning			-.00	.96	.07	.17
Prior team experience			-.00	.79	.00	.85
Prior ERP knowledge			-.02	.03*	.01	.38
Prior attitude			.01	.48	.02	.09
Prior involvement			.02	.08	.03	.07
Team-level effects						
Team cohesion (TCOH)			-.00	.97		
Rank performance	-.37 <sup>a</sup>	.03*				
Team-level controls						
Team size	-.46	.01*				
Cross-level moderations						
TCOH × Quality			.14 <sup>b</sup>	.02*		
TCOH × Enjoyment			-.12 <sup>c</sup>	.05*		
Model type	OLS		HLM		OLS	
N (individuals)	---		232		232	
N (teams)	78		78		---	
ICC(1)			.518			
ICC(2)			.811			
Deviance (-2 log likelihood)			429.5			
Adj. r-sq.	.14		.71		.50	
Multicollinearity checked	Yes		Yes		Yes	
Notes:						
<sup>a</sup> Used to test H1. Because low rank indicates better performance, the sign of the relationship between rank performance and team cohesion is negative. <sup>b</sup> Used to test H2. <sup>c</sup> Used to test H3. * <i>p</i> < .05, ** <i>p</i> < .01, *** <i>p</i> < .001.						

We conducted additional analyses to test H1 by using more control variables. One could argue that certain demographic and cognitive variables of the team members may influence team cohesion and should be controlled for. Thus, in addition to team size as included in Model 4 (results reproduced from Model 1), we also entered gender, age, prior team experience, and prior involvement with ERP learning into Models 5-6 (see Table 3), the rationale being that the team

members' levels and similarity on these factors may affect team cohesion. Because these variables were measured at the individual level, we used the mean (Model 5) and standard deviation (Model 6) of a team, respectively. As Table 3 shows, these additional controls did not explain much more variance of team cohesion; more importantly, the effect of rank performance remained strong and highly consistent across the models.

**Table 3. Robustness Model Results of Team Cohesion (Team Level)**

Independent variables	Team level model: Team cohesion					
	Model 4		Model 5		Model 6	
	Estimate	<i>p</i>	Estimate	<i>p</i>	Estimate	<i>p</i>
INTERCEPT	1.44	.01*	1.66	.24	1.32	.08†
Team-level effects						
Rank performance	-.37 <sup>a</sup>	.03*	-.41 <sup>a</sup>	.02*	-.39 <sup>a</sup>	.03*
Team-level controls						
Team size	-.46	.01*	-.35	.07†	-.37	.09†
Gender <i>mean</i>			-.42	.24		
Age <i>mean</i>			-.06	.30		
Prior team experience <i>mean</i>			.06	.43		
Prior involvement with ERP <i>mean</i>			.09	.09†		
Gender <i>stdev</i>					.25	.64
Age <i>stdev</i>					-.03	.68
Prior team experience <i>stdev</i>					-.07	.60
Prior involvement with ERP <i>stdev</i>					.03	.63
Model type	OLS		OLS		OLS	
N (Teams)	78		78		78	
Adj. R-sq	.14		.14		.10	
Multicollinearity checked	Yes		Yes		Yes	
Notes: “mean” refers to the variable’s arithmetic average of a team, “stdev” refers to the variable’s standard deviation of a team.						
<sup>a</sup> Relevant to H1. *p < .05, †p < .1						

*Tests of Cross-Level Moderation Effects:* Attitude had an ICC(1) of .518 ( $p < .001$ ), and thus it was necessary to use HLM to test H2 and H3. Column 2 of Table 2 shows these results. Team cohesion had a positive and significant moderation effect on the relationship between perceived quality and attitude ( $\beta = .14$ ,  $p = .02$ ). Thus, H2 was supported. We performed a formal comparison between a baseline model that included the main effect of quality and a research model that also included the interaction term between quality and team cohesion; the comparison was significant ( $\Delta\text{Deviance} (\chi^2) = 652.9 - 573.0 = 79.9$ ,  $df = 1$ ,  $p <$

.0001). The adjusted R-squared for this model was increased by 4.6 percentage points because of the addition of the moderation effect.

Table 2 also indicates that team cohesion had a significant negative moderation effect on the relationship between perceived enjoyment and attitude ( $\beta = -.12$ ,  $p = .05$ ). Thus, H3 was supported. A formal comparison of model goodness-of-fit revealed that the moderation effect significantly improved model fit from the baseline ( $\Delta\text{Deviance} = 652.9 - 569.3 = 83.6$ ,  $df = 1$ ,  $p < .0001$ ). Adding this moderation



effect resulted in an increase in adjusted R-squared of 3.1 percentage points.

#### 4.4 Post Hoc Analyses

*Effect of Team Performance on Team Cohesion:* It is important to note that the significant relationship between rank performance and team cohesion can merely indicate a correlation rather than a causation.

To support our argument, we collected an additional dataset with a total of 211 students in 64 teams. In particular, participants filled out the survey including team cohesion without knowing their team's performance. The results show that there was no correlation between rank performance and team cohesion ( $r = .03, p = .841$ ). As shown in Table 4, rank performance did not significantly influence team cohesion ( $\beta = .04, p = .779$ ).

**Table 4: Results Without Knowing Team Performance**

Independent variable	Dependent variable	
	Team cohesion	
	Estimate	<i>p</i>
Rank performance	.04	.779
Team size	-.07	.593

*Robustness Check for the Moderation Effect:* In accordance with Bhattacharjee and Sanford (2006), we also used a split-sample test as an alternative robustness check to test H2 and H3. Specifically, we split the sample in half according to *each team's* level of cohesion. This gave us two samples with an equal number of participants but slightly different numbers of teams (Table 5). We ran HLM on each sample and reported the main effects of perceived quality and perceived enjoyment on attitude in Table 5. Next, we statistically tested whether the effects of perceived quality and perceived enjoyment were equal across the

two samples. The results of the cross-sample coefficient test (Clogg, Petkova, & Haritou, 1995; Paternoster, Brame, Mazerolle, & Piquero, 1998) indicated that the effect of perceived quality was stronger in the high cohesion teams' sample than in the low cohesion teams' sample (.57 vs. .26, diff = .31,  $z = 2.49, p = .01$ ). Conversely, the effect of perceived enjoyment was weaker in the high cohesion teams' sample than in the low cohesion teams' sample (.28 vs. .58, diff = -.30,  $z = -2.43, p = .02$ ). These results are consistent with H2 and H3.

**Table 5. Comparing High and Low Cohesion Teams on the Effects of QUAL and ENJ**

Variables	High team cohesion		Low team cohesion		Comparison		
	Estimate	S.E.	Estimate	S.E.	Diff	z	p
Quality	.57	.10	.26	.08	.31	2.49	.01*
Enjoyment	.28	.09	.58	.08	-.30	-2.43	.02*
N (individual)	116		116				
N (team)	41		37				
Note: *p < .05							

To further support the presence of cross-level moderation effects, we separately plotted the comparison of the individual level effects that perceived quality and perceived enjoyment had on attitude in the high- and low-cohesion teams. Figure 2 (a) compares the slopes of perceived quality between the high and low cohesion teams, indicating that the slope of perceived quality in highly cohesive teams

(left: solid line) was much steeper (i.e., more positive) than that in less cohesive teams (left: dashed line). In contrast, Figure 2 (b) compares the high- and low-cohesion teams in terms of perceived enjoyment. Compared with the less cohesion teams (right: dashed line), the slope of perceived enjoyment was much flatter (i.e., less positive) in the highly cohesive teams (right: solid line).

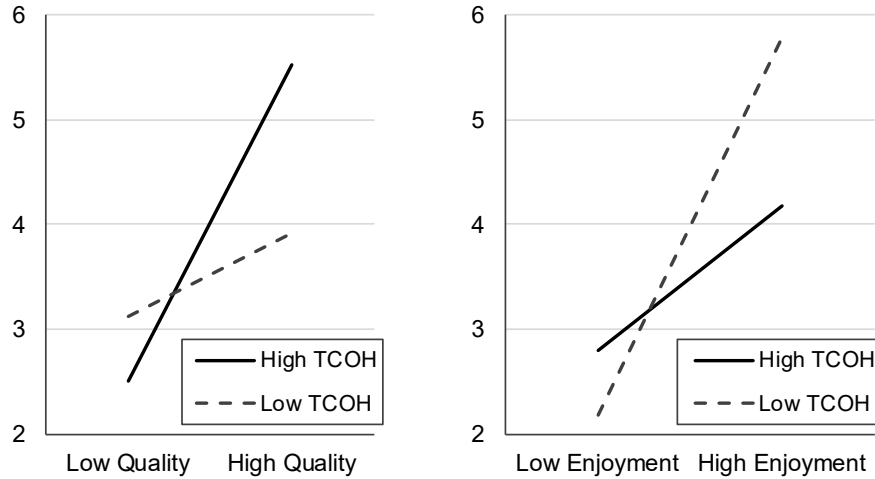


Figure 2. Slope of (a) Quality and (b) Enjoyment for High vs. Low Team Cohesion

## 5 Discussion and Conclusions

Overall, our results strongly emphasize the importance of teams in gamification and persuasion. In particular, our findings suggest that team-based gamification elements (e.g., leaderboard) and social groups (e.g., team cohesion) play important roles in human information processing in the context of team-based gamified training. Our results show that team performance positively influences team cohesion. We also found that individuals in a team with high cohesion use the central route for persuasion, but individuals in a team with low cohesion form their attitudes by using the peripheral route for persuasion.

### 5.1 Theoretical Contributions

Our study makes several theoretical contributions. First, we contribute to the literature on teams and gamification. Although teams are an important element in games (e.g., League of Legends) and gamification (e.g., ERPsim) (Werbach & Hunter, 2012), prior research on gamification has largely ignored this element. The individual level focus of gamification research has made it difficult to examine how the team-based game elements (e.g., team rank) influence team outcomes. Our results provide empirical support for the positive effect of team performance via the leaderboard on team cohesion, which in turn determines an individual's information processing. This finding further contributes to the applicability at the team level of motivational consistency theories such as balance theory (Heider, 1958).

Second, we contribute to the ELM literature by examining the moderating role of a team level construct (i.e., team cohesion) in individuals'

information processing in the context of team-based gamified training. Prior IS research has used ELM (e.g., Angst & Agarwal, 2009; Cheung et al., 2012; Ho & Bodoff, 2014), and general ELM research has also examined social groups as an important factor of the route to persuasion (e.g., Barden et al., 2014; Briñol et al., 2015; Petty et al., 1980; See & Petty, 2006). However, these studies have focused exclusively on the individual level of analysis. As with studies of collaboration technologies (Maruping & Magni, 2015), investigations of team-based gamification require consideration of the social processing within teams. Organizations commonly adopt hierarchical structures, and thus many phenomena in organizational research are multilevel (Kang et al., 2012). Although a multilevel approach is not new to IS research (e.g., Maruping & Magni, 2015), applying it for the purpose of understanding information processing and persuasion is somewhat novel. We found team cohesion to be an important team-level construct that determines the route to persuasion. In particular, we found that participants in highly cohesive teams were more influenced by the quality of learning (i.e., central route), and that participants in teams with low cohesiveness were more influenced by enjoyment (i.e., peripheral route).

Third, prior research has shown that utilitarian (e.g., perceived quality) and/or hedonic (e.g., perceived enjoyment) aspects of IT influence user behaviors (Bhattacharjee & Sanford, 2006; Van der Heijden, 2004; Venkatesh et al., 2012). Our study shows that these two aspects do not influence user attitudes unconditionally. We identified a boundary condition (i.e., high vs. low team cohesion) under which the order of importance of the two aspects may be reversed. Specifically, our results suggest that the quality of learning via ERPsim plays a central role in

shaping attitude when team cohesion is high, and that it does not necessarily do so when team cohesion is low. If team members share a low level of morale and cohesiveness, enjoyment becomes more effective than quality in forming the learning attitude.

## 5.2 Practical Contributions

With respect to our specific findings, there are several ways that managers, team leaders, and executives could improve the effectiveness of project teams in their organizations. In general, they could utilize our findings to justify the use and expense of gamification in work environments. More specifically, managers could utilize the finding that performance and cohesion influence each other reciprocally: not only does cohesion influence performance, but performance also influences cohesion. Workplace situations may exist in which managers are unable to evaluate a project team's cohesion directly; however, if the team performs well, the manager might infer a higher level of cohesion and opt to keep the team together on future projects.

In addition to predicting team cohesion based on performance, managers and team leaders could also actively promote it. We expect our findings to be especially useful for motivating young (i.e., entry-level or less-experienced) professional workers who use ERP systems in their jobs. Managers should try to identify each team's unique strengths and reward them. For example, managers could appropriate their access to the often enormous amount of system usage statistics of different teams and individuals and selectively "spotlight" a winning team in each performance category—e.g., the best team to achieve the highest revenue, profit, return on assets, and so forth. These awards would often go different teams so that members of each team would have a unique reason to come together.

Although high team cohesion has been known as producing positive outcomes (Venkatesh and Windeler 2012; Yang and Tang 2004; Yang et al., 2015), there are times when low team cohesion may yield better outcomes. Our results show that when people are in a more (vs. less) cohesive team, they are likely to be influenced by the utilitarian (vs. hedonic) aspects in technology training. Thus, managers are advised to channel the attention of less cohesive teams toward peripheral route cues in order to improve individuals' attitudes—such strategies would also likely be useful for cohesive teams and central route cues. Additionally, managers and team leaders should emphasize utilitarian (vs. hedonic) aspects when motivating cohesive (vs. less cohesive) teams.

Pedagogically, we found that making the teams aware of their relative performance in comparison to other teams (e.g., in the form of a leaderboard system or ranking scheme), may not always encourage students

or trainees. This is because knowledge of performance ranking directly affects perceived team cohesion. Although such knowledge may instill more seriousness in higher-cohesion team members and create a more favorable attitude toward the utilitarian value of learning, this awareness may cause members of less cohesive teams to focus more on the hedonic value of the training subject. As for learning about ERP systems, serious subjects of learning tend to be more intense and thus perhaps less enjoyable. Therefore, people in lower performing teams might begin to lose interest in learning as part of the team. Instead of using a standard leaderboard system that displays the same information to all teams, customized feedback may be more valuable. For instance, we would recommend dispensing ranking information only to high ranking teams. Lower ranking teams should receive positive feedback on their strengths and be offered guidance on how to correct their weaknesses instead.

## 5.3 Limitations and Future Research Directions

Our study is not without limitations. First, we used student subjects enrolled in an introductory-level IT course. Although this is a natural class setting, it could limit the generalizability of the results. Future research should further test and validate the research model based on potential ERP users in firms or perhaps on student subjects who register for advanced ERP courses. Second, the results are based on a basic distribution game. Future research using advanced versions of ERPsims or other types of business simulation games could potentially enhance the generalizability of the results. Third, although we controlled for various factors at the team and individual levels, there may be factors that affect team-based gamified training that were excluded here. For instance, the personality factors of each team member may potentially have an impact on performance and cohesion. Thus, readers should interpret our results with caution. Fourth, although ELM researchers like Petty, Cacioppo, & Schumann (1983) and others have manipulated central and peripheral cues in a lab experimental setting, our study did not manipulate these variables in the same way.

Our study provides a useful foundation for future research. We have shown how attitude formation is affected by the positive moderation of team cohesion on the effect of perceived quality and also by the negative moderation of team cohesion on the effect of perceived enjoyment. Based on these findings, one interesting direction for future research would be to examine other team-level constructs that determine the route to persuasion. Recent research on collaborative technologies has investigated various team-level constructs such as team size and dispersion (Alnuaimi et al., 2010), team learning and empowerment climate

(Maruping & Magni, 2012), consensus of appropriation (Kang et al., 2012), and team empowerment (Maruping & Magni, 2015). In seeking to understand how individuals form their attitudes, future research on persuasion would likewise benefit from examining these team-level constructs.

Our findings on the impact of performance on team cohesion should be useful to future IS research on virtual teams. It may be especially challenging to build a cohesive virtual team because of the geographic and/or temporal separation of team members (Yang et al., 2015). Thus, it would be reasonable to foresee a more salient impact of prior performance on subsequent cohesion. We therefore urge IS researchers

studying team cohesion in virtual environments to test this prediction, or at least control for this factor even if their focus is on other important antecedents of team cohesion, because failure to consider the likely confounding influence of prior performance may result in misleading conclusions.

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## Appendix A

### A1: Leaderboard

**Team performance** is scored as a numerical ranking and is displayed to all teams. A screenshot from ERPSim illustrates such a display:

TEAM	CREDIT RATINGS	INTEREST RATE (%)	RANK	CUMULATIVE NET INCOME	TOTAL SALES	GROSS MARGIN (%)	NET MARGIN (%)	ROE (%)	ROA (%)	D/E (%)
O		0.000	1	34,343.00	427,691.70	8.030	8.030	6.427	5.144	24.957
J		0.000	2	32,471.23	514,089.18	6.316	6.316	6.098	4.877	25.044
K		0.000	3	25,944.06	492,665.25	5.266	5.266	4.933	3.935	25.355
M		0.000	4	25,472.81	406,190.10	6.271	6.271	4.848	3.866	25.378
P		0.000	5	20,767.29	413,062.74	5.028	5.028	3.988	3.175	25.607
I		0.000	6	11,426.93	448,589.37	2.547	2.547	2.234	1.772	26.075
L		0.000	7	7,816.81	657,955.56	1.188	1.188	1.539	1.219	26.260

### A2: Survey Instruments

#### Team Cohesion (Chin et al., 1996)

TCOH1: I feel that I belong to my team.

TCOH2: I am happy to be part of my team.

TCOH3: I see myself as part of my team.

TCOH4: My team is one of the best anywhere.

TCOH5: I feel that I am a member of my team.

TCOH6: I am content to be a part of my team.

#### Perceived Quality (Bhattacharjee & Sanford, 2006)

QUAL1: In learning ERP systems, what I learned via the SAP simulation game was informative.

QUAL2: In learning ERP systems, what I learned via the SAP simulation game was helpful.

QUAL3: In learning ERP systems, what I learned via the SAP simulation game was valuable.

#### Perceived Enjoyment (Venkatesh et al., 2012)

ENJ1: Learning via the SAP simulation game was enjoyable.

ENJ2: Learning via the SAP simulation game was fun.

ENJ3: Learning via the SAP simulation game was exciting.

#### Attitude (Ajzen, 1991)

For me, learning via the SAP simulation game is

ATT1: (a bad idea/a good idea)

ATT2: (foolish/beneficial)

ATT3: (undesirable/desirable)



**Intention to Learn ERP Systems** (Davis et al., 1989)

WTL1: I intend to learn more about ERP systems.

WTL2: I predict that I will learn more about ERP systems.

WTL3: I am willing to learn more about ERP systems.

**Prior ERP Knowledge** (Bhattacharjee & Sanford, 2006)

PRKN1: The level of my ERP knowledge is high.

PRKN2: The level of my ERP experience is high.

PRKN3: The level of ERP competency is high.

**Prior Involvement with Learning about ERP Systems** (Bhattacharjee & Sanford, 2006)

PRINV1: In general, I have strong interest in learning about ERP systems.

PRINV2: Learning about ERP systems is very important to me.

PRINV3: Learning about ERP systems matters a lot to me.

**Prior Attitude toward Learning about ERP Systems** (Ajzen, 1991)

For me, learning about ERP systems is

PRATT1 (a bad idea/a good idea)

PRATT2 (foolish/beneficial)

PRATT3 (undesirable/desirable)

**Prior ERP Experience**

Have you learned about ERP systems before this class?

**Prior Team Experience**

Have you been part of a team before this class?

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